PATENT ABSTRACTS OF JAPAN

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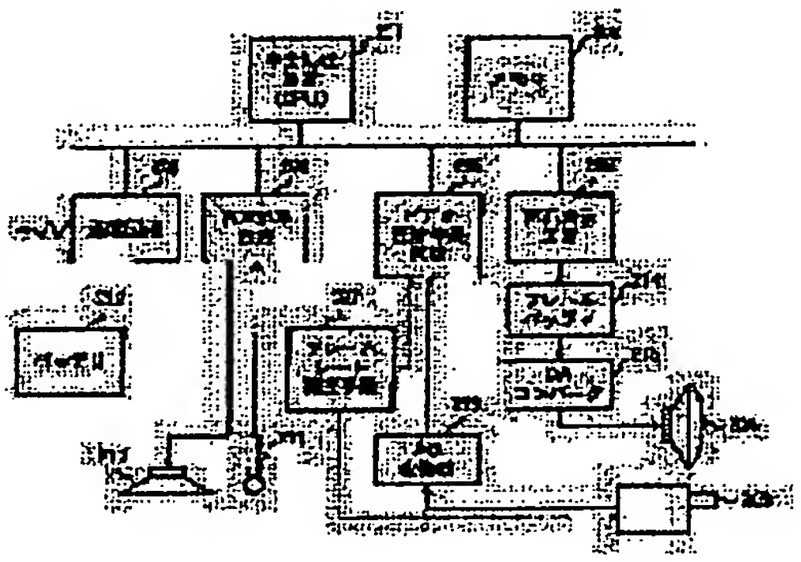
(71)Applicant : TOSHIBA CORP
(72)Inventor : TAKAHASHI MASASHI

(54) PORTABLE INFORMATION TERMINAL EQUIPMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To attain the reduction of power consumption due to moving image data compressing processing when a low frame rate is set by adjusting the value of frame rate in the image pickup of moving image and the value of frame rate in the compressing processing of moving image data corresponding to operation from the outside.

SOLUTION: A CCD camera 203 inputs the moving image according to the frame rate set by a frame rate adjusting means 207 through a frame rate adjust knob and A/D converter 213 converts inputted analog moving image signals to digital moving image data and stores them in the frame memory of video compression/extension circuit 206. In this case, the circuit 206 compresses the moving image data inputted from the camera 203 and transfers them to a communication circuit 208. Then, the operating clock frequency of circuit 206 is controlled to an irreducibly minimum operating clock frequency according to the frame rate set by the adjusting means 207. Besides, when the frame rate is lower than a prescribed value, the circuit 206 is controlled so as not to perform motion compensation.



CLAIMS

[Claim(s)]
[Claim 1]In a personal digital assistant device characterized by comprising the following, A personal digital assistant device provided with a frame rate regulation means which adjusts a value of a frame rate in compression processing of dynamic image data based on a value of a frame rate in an image pick-up of video by said video imaging means and said dynamic-image-data compression processing means.
A video imaging means which picturizes video.
A dynamic-image-data compression processing means which carries out compression processing of the dynamic image data which picturized video by said video imaging means, and was incorporated.
A means of communication which transmits to the exterior dynamic image data by which compression processing was carried out by said dynamic-image-data compression processing means.

[Claim 2]A personal digital assistant device having further a cine mode display means to display video, in the personal digital assistant device according to claim 1.
[Claim 3]A personal digital assistant device, wherein variable control of the clock frequency of said dynamic-image-data compression processing means is carried out according to a value of a frame rate adjusted by said frame rate regulation means in claim 1 or a personal digital assistant device given in either of 2.
[Claim 4]A personal digital assistant device with which clock frequency is characterized by carrying out variable control so that necessary minimum arithmetic proficiency according to a value of a frame rate by which said dynamic-image-data compression processing means was adjusted by said frame rate regulation means in the personal digital assistant device according to claim 3 may be obtained.
[Claim 5]A personal digital assistant device characterized by said dynamic-image-data compression processing means being what has a motion compensation means to perform an inter-frame motion compensation in the personal digital assistant device according to any one of claims 1 to 4.
[Claim 6]In the personal digital assistant device according to claim 5, when a value of a frame rate is adjusted by said frame rate regulation means below at a predetermined value, A personal digital assistant device characterized by said dynamic-image-data compression processing means' stopping operation of said motion compensation means, and keeping it from performing said motion compensation.

[Claim 7]A personal digital assistant device, wherein regulation of a value of a frame rate by said frame rate regulation means is performed according to operation from the outside in the personal digital assistant device according to any one of claims 1 to 6.
[Claim 8]A personal digital assistant device, wherein regulation of a value of a frame rate by said frame rate regulation means is performed to said personal digital assistant device according to remaining capacity of a battery which supplies electric power in the personal digital assistant device according to any one of claims 1 to 6.
[Claim 9]A personal digital assistant device which is provided with the following and characterized by carrying out variable control of the clock frequency of said dynamic-image-data compression processing means according to a value of a frame rate adjusted by said frame rate regulation means.
A camera which picturizes video by a frame rate of an adjusted value.
A dynamic-image-data compression processing means which carries out compression processing of the dynamic image data changed from video picturized with said camera.
A means of communication which transmits to the exterior dynamic image data by which compression processing was carried out by said dynamic-image-data compression processing means.

A frame rate regulation means which adjusts a value of said frame rate in an image pick-up of video with said camera, and a value of a frame rate of dynamic image data by which compression processing is carried out according to operation from the outside.

[Claim 10]A personal digital assistant device which is provided with the following and characterized by carrying out variable control of the clock frequency of said dynamic-image-data compression processing means according to a value of a frame rate adjusted by said frame rate regulation means.
A battery which supplies electric power.
A camera which picturizes video by a frame rate of an adjusted value.
A dynamic-image-data compression processing means which carries out compression processing of the dynamic image data changed from video picturized with said camera.
A means of communication which transmits to the exterior dynamic image data by which compression processing was carried out by said dynamic-image-data compression processing means, A frame rate regulation means which adjusts a value of said frame rate in an image pick-up of video with said camera, and a value of a frame rate of dynamic image data by which compression processing is carried out according to remaining capacity of said battery.

[Claim 11]In a personal digital assistant device of a statement, to claim 9 or either of 10, clock frequency of said dynamic-image-data compression processing means, A personal digital assistant device, wherein variable control is carried out according to a value of a frame rate adjusted by said frame rate regulation means so that necessary minimum arithmetic proficiency in said dynamic-image-data compression processing means may be obtained.
[Claim 12]A personal digital assistant device characterized by said dynamic-image-data compression processing means being what has a motion compensation means to perform an inter-frame motion compensation in the personal digital assistant device according to any one of claims 9 to 11.
[Claim 13]In the personal digital assistant device according to claim 12, when a value of a frame rate is adjusted by said frame rate regulation means below at a predetermined value, A personal digital assistant device characterized by said dynamic-image-data compression processing means' stopping operation of said motion compensation means, and keeping it from performing said motion compensation.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]About a personal digital assistant device, especially this invention performs reception or transmission and reception of video, and enables reduction of the power consumption of the personal digital assistant device which realizes a portable TV phone etc.
[0002]
[Description of the Prior Art]It carries freely in recent years and the needs of the made personal digital assistant device are growing. With a personal digital assistant device, from cellular phones, such as PHS (Personal Handyphone System). Personal information tools, such as PDA (Personal Data Assistant), and the apparatus in which even portable computers, such as a subnote type personal computer, are still wide range shall be pointed out.
[0003]It is considered that it realizes and a portable video telephone function is realized with such [in the future] a near personal digital assistant device to perform reception or transmission and reception of video.
[0004]Drawing 5 is an outline view of the example of 1 composition of the personal digital assistant device which has a portable video telephone function.
[0005]The personal digital assistant device of drawing 5 comprises the liquid crystal display screen and the input pad 503, CCD camera 504, the loudspeaker 505, the microphone 506, and the communication MODEM terminal 507 with which the main part 501 was equipped. When a user inputs into a liquid crystal display screen and the input pad 503 with an input pen etc. and it uses as a portable TV phone, The data of a picture and a sound inputted from CCD camera 504 and the microphone 506 is transmitted via the communication MODEM terminal 507, and the data of the picture and sound which received is reproduced by the liquid crystal display screen 503 and the loudspeaker 505.
[0006]Picture transceiver **** using this personal digital assistant device is performed as follows. The dynamic image data inputted from the CCD camera is compressed by the video compression expansion circuit, and radio is carried out through a communication circuit. On the other hand, elongation processing of the image data which the communication circuit received is carried out by the video compression expansion circuit, and it is outputted to the liquid crystal display screen 503 through a video output device. Thus, the function of a portable TV phone is realized. The video compression expansion circuit can consider having corresponded to the International Standard of media integrated system video compression of H.261, H.263, MPEG1, MPEG4, etc. In order to realize these functions, a video compression expansion circuit with the high throughput of several 10 - number 100MOPS (Million Operations Per Second) is needed, and power consumption also becomes large inevitably. An example of the dynamic-image-data compression procedure in the image data transmitting side is as follows.
[0007](1) Ask for the difference of the image data of a present frame, and the image data of one frame ago. The direction and size (motion vector) of a motion are detected (motion detection (ME:Motion Estimation)), it asks for difference with the field where only the part of the motion vector moved, and a motion compensation (MC:MotionCompensation) is performed by a 16x16-pixel macro block unit.
[0008](2) Carry out the discrete cosine transform (DCT:Discrete Cosine Transform) of the difference for which it asked, by quantizing further (Q:Quantize), compress the amount of information and consider it as compression difference information.
[0009]The motion vector for which it asked by (3) and (1), and the compression difference information searched for by (2) are outputted as compressed image data.
[0010]On the other hand, the discrete cosine transform of the picture which cannot do the first picture or a motion compensation is carried out [not performing a motion compensation], and it is transmitted.

The picture to which such a motion compensation is not carried out is called Intra picture. On the other hand, the picture which the motion compensation was performed and became difference information with the image data of a front frame is called interchange picture. Usually, three are an interchange picture in about 2/of all the pictures.

[0011]Dynamic-image-data elongation processing in an image data receiver is performed as follows in a procedure contrary to the image data compression procedure in the above-mentioned image data transmitting side.

[0012](1) Carry out inverse quantization (Q^{-1}) of the image data which received, and carry out a reverse discrete cosine transform (IDCT:Indiscrete Cosine Transform).

[0013]When the picture by which inverse quantization was carried out by (2) and (1) is an interchange picture, it shifts by the motion vector which received simultaneously, and adds to the image data of the frame in front of one.

[0014]Since what drives a personal digital assistant device with a battery is in use when performing such dynamic-image-data compression elongation processing on a personal digital assistant device, battery temporal duration becomes remarkably short.

[0015]on the other hand, the video transmitted and received does not necessarily need to be smooth video -- for example, the picture of a still picture or the frame rate (frame number per unit time) of about one frame per second -- necessity -- there may also be sufficient thing. In this case, since the operation amount which dynamic-image-data compression elongation processing takes will decrease if a frame rate is reduced, power consumption is also stopped low and battery-operated time becomes long.

[0016]

[Problem(s) to be Solved by the Invention]However, it is a personal digital assistant device which can perform reception or transmission and reception of the video above until now, The thing provided with a means by which a user adjusts the frame rate of dynamic image data does not exist, but power consumption increases by processing image data by a high frame rate superfluously in a user, and there is a problem that consumption of a battery becomes quick.

[0017]This invention was made in view of this problem, it is a personal digital assistant device which can perform reception or transmission and reception of video, and that purpose is to provide the personal digital assistant device of the composition which can reduce power consumption.

[0018]

[Means for Solving the Problem]As mentioned above, since dynamic-image-data compression elongation processing needs a great operation amount, in a dynamic-image-data compression expansion circuit, power consumption becomes large. On the other hand, since battery-operated [of the personal digital assistant device] is carried out, it is necessary to control power consumption but, and if a time-varying-image-processing function tends to be included in a personal digital assistant device and it is going to realize a portable TV phone etc., battery temporal duration cannot but become short.

[0019]Then, in a personal digital assistant device concerning this invention, in order to control power consumption by dynamic-image-data compression elongation processing, a frame rate regulation means which has a frame rate regulation knob etc. which can change a frame rate of image data themselves [user] is established. H. Although an animation of about per second 15 frames is treated in a TV phone by 263 standards, for example, By there being also a case of necessity 10 minutes by a frame rate lower than this for some users, and setting a frame rate regulation knob of a frame rate regulation means to the low frame rate side in that case, A frame rate is reduced and it becomes possible to reduce power consumption and to extend battery temporal duration.

[0020]When a frame rate is low set up in video transmission, first, clock frequency of a CCD camera falls and a video sampling rate falls. Thereby, power consumption in a CCD camera can be reduced.

[0021]Next, also in image data compression processing, clock frequency is set up low, and power consumption can be reduced. Since it will become meaningless to perform a motion compensation if it becomes below a value (for example, five frames per second) with setting out of a frame rate, a motion compensation circuit is bypassed and difference processing inter-frame [each] is omitted. Thereby, power consumption by a motion compensation circuit can be eliminated.

[0022]When transmitting compressed dynamic image data, frame rate information on video is also transmitted simultaneously. Although elongation processing of dynamic image data is first performed at speed according to a frame rate of video which received, a receiver of video performs elongation processing of dynamic image data, operating dynamic image data on a curtailed schedule, when frame rate regulation is low set up rather than a frame rate of video which received.

[0023]Although a means described above is a means in case a user sets up setting out of a frame rate

using a frame rate regulation means which has a frame rate regulation knob etc., A thing which it seems shall set up a frame rate for a frame rate regulation means automatically according to remaining capacity of a battery is also possible. In this case, if battery capacity decreases, a frame rate will be adjusted automatically, it will be set up low, and power consumption will be reduced.
[0024]
[Embodiment of the Invention]Hereafter, the embodiment of the personal digital assistant device concerning this invention is described, referring to drawings.
[0025]Drawing 1 is an outline view in one gestalt of operation of the personal digital assistant device concerning this invention.
[0026]The personal digital assistant device of drawing 1 comprises the frame rate regulation knob 102, the liquid crystal display screen and the input pad 103, CCD camera 104, the loudspeaker 105, the microphone 106, and the communication MODEM terminal 107 with which the main part 101 was equipped. When a user inputs into a liquid crystal display screen and the input pad 103 with an input pen etc. and it uses as a portable TV phone, The data of a picture and a sound inputted from CCD camera 104 and the microphone 106 is transmitted via the communication MODEM terminal 107, and the data of the picture and sound which received is reproduced by the liquid crystal display screen 103 and the loudspeaker 105. The frame rate of the data of the picture transmitted and reproduced can be adjusted via the frame rate regulation knob 102 by the frame rate regulation means with which the inside was equipped.
[0027]Drawing 2 is a block lineblock diagram of the personal digital assistant device concerning a 1st embodiment of this invention.
[0028]The personal digital assistant device concerning a 1st embodiment of this invention comprises: The central processing unit (CPU) 201, the memory 202, the screen display device 205, the video compression expansion circuit 206, the communication circuit 208, and the speech processing unit 209 which were connected mutually.
CCD camera 203 connected to the video compression expansion circuit 206 via A/D converter 213.
The frame rate regulation means 207 which has the frame rate regulation knob etc. which were connected to the video compression expansion circuit 206 and CCD camera 203.
The display screen 204 connected to the screen display device 205 via the frame buffer 214 and DA converter 215, the loudspeaker 210 and the microphone 211 which were connected to the speech processing unit 209, and the battery 212 which supplies electric power to each part of this personal digital assistant device.

[0029]The central processing unit 201 controls this whole personal digital assistant device, and it performs a required operation, accessing the memory 202. The screen display device 205 displays the dynamic image data from information or the video compression expansion circuit 206 directed from the central processing unit 201 on the display screens 204, such as a liquid crystal display. The video compression expansion circuit 206 performs compression elongation processing of dynamic image data, for example according to the dynamic image data compression system by which the standard was carried out by the international standards of media integrated system video compression of H.263, MPEG4, etc. CCD camera 203 receives video from the exterior, and transmits it to a video compression expansion circuit as dynamic image data. The microphone 211 changes into an electrical signal the sound which received from the outside, and transmits it to the speech processing unit 209 as voice data. The communication circuit 208 transmits the dynamic image data from the video compression expansion circuit 206, the voice data from the speech processing unit 209, and the information from CPU201 to other information terminal equipment by a cable or radio, or receives these information from other information terminal equipment. The battery 212 supplies the electric power of ********** of this personal digital assistant device. The frame rate regulation means 207 has a mechanism in which CCD camera 203 and the video compression expansion circuit 206 are told about the frame rate value set to the frame rate regulation knob for a user to set up a frame rate.
[0030]When realizing a portable TV phone using the personal digital assistant device concerning a 1st embodiment of this invention, processing of the data in the inside of a device, etc. is performed as follows.
[0031]The dynamic image data inputted from CCD camera 203 is inputted into the video compression expansion circuit 206 via A/D converter 213, and compression processing is carried out by the video compression expansion circuit 206. Compression processing also of the voice data inputted from the microphone is carried out with the speech processing unit 209. These image data and voice data are

transmitted via the communication circuit 208.
[0032]In the data compression elongation processing in the video compression expansion circuit 206, compression processing of the image data inputted from CCD camera 203 is carried out, for example according to the video compression standards of H.263 grade. Here, data compression processing is explained taking the case of the case of the method of H.263 standard.
[0033]CCD camera 203 inputs video according to the frame rate set up by the frame rate regulation means 207 via the frame rate regulation knob, and A/D converter 213, The inputted analog dynamic image signal is changed into digital dynamic image data, and it stores in the frame memory of the video compression expansion circuit 206. The video compression expansion circuit 206 compresses the dynamic image data inputted from CCD camera 203, and transmits it to the communication circuit 208. The operation clock frequency of the video compression expansion circuit 206 is controlled by the necessary minimum operation clock frequency according to the frame rate set up by the frame rate regulation means 207. When a frame rate is a less than predetermined value, for example, five frames per second, the video compression expansion circuit 206 does not perform a motion compensation, but is controlled to consider it only as the image data of the Intra picture. Since the number of bits of the data transmitted even if it does not perform a motion compensation not becoming so large, and an inter-frame motion become large when a frame rate is small, the case where a motion compensation is not made depends this on generating mostly.
[0034]Drawing 3 is a block lineblock diagram of the video compression elongation processing circuit in the personal digital assistant device concerning this invention.
[0035]This video compression elongation processing circuit An outline, PLL circuit 301, and the encoding controlling part 302, The discrete cosine transform (DCT:Discrete Cosine Transform) part 303, The quantization (Q:Quantize) part 304 and the variable wavelength numerals multiplexing device (VLC MUX:Variable Length Code Multiplexer) 305, The buffer 306, the inverse quantization (Q^{-1}) part 307, and the reverse discrete cosine transform (IDCT:Indiscrete Cosine Transform) part 308, It comprises the motion compensation (MC:Motion Compensation) part 309 and the motion detection (ME:Motion Estimation) part 310.
[0036]Image data compression processing in this video compression expansion circuit is performed as follows. The numerals shown in the parenthesis correspond to the means on drawing 3 which performs the processing concerned.
[0037](1) Ask for the difference of the image data of a present frame, and the image data of one frame ago. The direction and size (motion vector) of a motion are detected (numerals (motion detection (ME:Motion Estimation)) 310), It asks for difference with the field where only the part of the motion vector moved, and a motion compensation (MC:Motion Compensation) is performed by a 16x16-pixel macro block unit (numerals 309).
[0038](2) Carry out the discrete cosine transform (DCT:Discrete Cosine Transform) of the difference for which it asked (numerals 303), by quantizing further (Q:Quantize), compress the amount of information (numerals 304) and consider it as compression difference information.
[0039]The motion vector for which it asked by (3) and (1), and the compression difference information searched for by (2) are outputted as compressed image data (numerals 305,306).
[0040]On the other hand, the discrete cosine transform of the picture which cannot do the first picture or a motion compensation is carried out [not performing a motion compensation], and it is transmitted. As mentioned above, the picture to which such a motion compensation is not carried out is called Intra picture. On the other hand, the picture which the motion compensation was performed and became difference information with the image data of a front frame is called interchange picture. Usually, three are an interchange picture in about 2/of all the pictures.
[0041]Dynamic-image-data elongation processing in an image data receiver is performed as follows in a procedure contrary to the image data compression procedure in the above-mentioned image data transmitting side.
[0042](1) Carry out inverse quantization (Q^{-1}) of the image data which received (numerals 307), and carry out a reverse discrete cosine transform (IDCT:Indiscrete Cosine Transform) (numerals 308).
[0043]When the picture by which inverse quantization was carried out by (2) and (1) is an interchange picture, it shifts by the motion vector which received simultaneously, and adds to the image data of the frame in front of one.
[0044]Thus, elongation processing is performed in a video compression expansion circuit, and the image data which the communication circuit received is outputted to a display screen by a screen display device.

[0045]Drawing 4 is a block lineblock diagram of the personal digital assistant device concerning a 2nd embodiment of this invention.
[0046]The personal digital assistant device concerning a 2nd embodiment of this invention comprises: The central processing unit (CPU) 201, the memory 202, the screen display device 205, the video compression expansion circuit 206, the communication circuit 208, and the speech processing unit 209 which were connected mutually.
CCD camera 203 connected to the video compression expansion circuit 206 via A/D converter 213.
Frame rate regulation means 207' which is connected to the video compression expansion circuit 206 and CCD camera 203, and has a remaining capacity detection function of the battery 212.
The display screen 204 connected to the screen display device 205 via the frame buffer 214 and DA converter 215, The loudspeaker 210 and the microphone 211 which were connected to the speech processing unit 209, and the battery 212 which is connected to frame rate regulation means 207' for remaining capacity detection, and supplies electric power to each part of this personal digital assistant device.

[0047]The central processing unit 201 controls this whole personal digital assistant device, and it performs a required operation, accessing the memory 202. The screen display device 205 displays the dynamic image data from information or the video compression expansion circuit 206 directed from the central processing unit 201 on the display screens 204, such as a liquid crystal display. The video compression expansion circuit 206 performs compression elongation processing of dynamic image data, for example according to the dynamic image data compression system by which the standard was carried out by the international standards of media integrated system video compression of H.263, MPEG4, etc. CCD camera 203 receives video from the exterior, and transmits it to a video compression expansion circuit as dynamic image data. The microphone 211 changes into an electrical signal the sound which received from the outside, and transmits it to the speech processing unit 209 as voice data. The communication circuit 208 transmits the dynamic image data from the video compression expansion circuit 206, the voice data from the speech processing unit 209, and the information from CPU201 to other information terminal equipment by a cable or radio, or receives these information from other information terminal equipment. The battery 212 supplies the electric power of ********** of this personal digital assistant device. Frame rate regulation means 207' detects the remaining capacity of the battery 212, and it has a mechanism in which set up a low frame rate when there is little remaining capacity, and CCD camera 203 and the video compression expansion circuit 206 are told about the set-up frame rate value.
[0048]The point that the personal digital assistant device concerning a 2nd embodiment of this invention differs from the personal digital assistant device concerning a 1st embodiment is a point that frame rate regulation means 207' detects the remaining capacity of the battery 212 rather than is operated manually, and sets up a frame rate automatically.
[0049]When realizing a portable TV phone using the personal digital assistant device concerning a 2nd embodiment of this invention, processing of the data in the inside of a device, etc. is the same as that of the personal digital assistant device applied to a 1st embodiment except for operation of frame rate regulation means 207', and is performed as follows.
[0050]The dynamic image data inputted from CCD camera 203 is inputted into the video compression expansion circuit 206 via A/D converter 213, and compression processing is carried out by the video compression expansion circuit 206. Compression processing also of the voice data inputted from the microphone is carried out with the speech processing unit 209. These image data and voice data are transmitted via the communication circuit 208.
[0051]In the data compression elongation processing in the video compression expansion circuit 206, compression processing of the image data inputted from CCD camera 203 is carried out, for example according to the video compression standards of H.263 grade. Here, data compression processing is explained taking the case of the case of the method of H.263 standard.
[0052]CCD camera 203 inputs video according to the frame rate automatically set up by frame rate regulation means 207' according to battery residual capacity, and A/D converter 213, The inputted analog dynamic image signal is changed into digital dynamic image data, and it stores in the frame memory of the video compression expansion circuit 206. The video compression expansion circuit 206 compresses the dynamic image data inputted from CCD camera 203, and transmits it to the communication circuit 208. The operation clock frequency of the video compression expansion circuit 206 is controlled by the necessary minimum operation clock frequency according to the frame rate

automatically set up by frame rate regulation means 207' according to battery residual capacity. When a frame rate is a less than predetermined value, for example, five frames per second, the video compression expansion circuit 206 does not perform a motion compensation, but is controlled to consider it only as the image data of the Intra picture, and the reason is as having mentioned above in explanation of a 1st embodiment.

[0053]Image data compression processing in a video compression expansion circuit is performed like a 1st embodiment.

[0054]

[Effect of the Invention]According to the 1st composition of the personal digital assistant device concerning this invention, the value of the frame rate in compression processing of the dynamic image data based on the value of a frame rate and dynamic-image-data compression processing means in the image pick-up of the video by video imaging means, such as a CCD camera, Since it had the frame rate regulation means adjusted according to the operation from the outside, When a user can set up arbitrarily the frame rate of the dynamic image data transmitted and reproduced if needed and a low frame rate is set up, the power consumption by dynamic-image-data compression processing can be reduced. When a frame rate is set up lower than a predetermined value, power consumption can be further reduced by omitting the motion compensation processing in dynamic-image-data compression processing.

[0055]According to the 2nd composition of the personal digital assistant device concerning this invention, the value of the frame rate in compression processing of the dynamic image data based on the value of a frame rate and dynamic-image-data compression processing means in the image pick-up of the video by video imaging means, such as a CCD camera, Since it had the frame rate regulation means adjusted according to the remaining capacity of the battery which supplies electric power to a personal digital assistant device, The frame rate of the dynamic image data transmitted and reproduced can be set up according to the remaining capacity of a battery, and when the remaining capacity of a battery decreases, battery-operated time of a personal digital assistant device can be lengthened by setting up a frame rate low.

[Translation done.]

* NOTICES *

TECHNICAL FIELD

[Field of the Invention]About a personal digital assistant device, especially this invention performs reception or transmission and reception of video, and enables reduction of the power consumption of the personal digital assistant device which realizes a portable TV phone etc.

[Translation done.]

* NOTICES *

PRIOR ART

[Description of the Prior Art]It carries freely in recent years and the needs of the made personal digital assistant device are growing. With a personal digital assistant device, from cellular phones, such as PHS (Personal Handyphone System). Personal information tools, such as PDA (Personal Data Assistant), and the apparatus in which even portable computers, such as a subnote type personal computer, are still wide range shall be pointed out.
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[0005]The personal digital assistant device of drawing 5 comprises the liquid crystal display screen and the input pad 503, CCD camera 504, the loudspeaker 505, the microphone 506, and the communication MODEM terminal 507 with which the main part 501 was equipped. When a user inputs into a liquid crystal display screen and the input pad 503 with an input pen etc. and it uses as a portable TV phone, The data of a picture and a sound inputted from CCD camera 504 and the microphone 506 is transmitted via the communication MODEM terminal 507, and the data of the picture and sound which received is reproduced by the liquid crystal display screen 503 and the loudspeaker 505.
[0006]Picture transceiver **** using this personal digital assistant device is performed as follows. The dynamic image data inputted from the CCD camera is compressed by the video compression expansion circuit, and radio is carried out through a communication circuit. On the other hand, elongation processing of the image data which the communication circuit received is carried out by the video compression expansion circuit, and it is outputted to the liquid crystal display screen 503 through a video output device. Thus, the function of a portable TV phone is realized. The video compression expansion circuit can consider having corresponded to the International Standard of media integrated system video compression of H.261, H.263, MPEG1, MPEG4, etc. In order to realize these functions, a video compression expansion circuit with the high throughput of several 10 - number 100MOPS (Million Operations Per Second) is needed, and power consumption also becomes large inevitably. An example of the dynamic-image-data compression procedure in the image data transmitting side is as follows.
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[0010]On the other hand, the discrete cosine transform of the picture which cannot do the first picture or a motion compensation is carried out [not performing a motion compensation], and it is transmitted. The picture to which such a motion compensation is not carried out is called Intra picture. On the other hand, the picture which the motion compensation was performed and became difference information with the image data of a front frame is called interchange picture. Usually, three are an interchange picture in about 2/of all the pictures.
[0011]Dynamic-image-data elongation processing in an image data receiver is performed as follows in a procedure contrary to the image data compression procedure in the above-mentioned image data

transmitting side.

[0012](1) Carry out inverse quantization (Q^{-1}) of the image data which received, and carry out a reverse discrete cosine transform (IDCT:Indiscrete Cosine Transform).

[0013]When the picture by which inverse quantization was carried out by (2) and (1) is an interchange picture, it shifts by the motion vector which received simultaneously, and adds to the image data of the frame in front of one.

[0014]Since what drives a personal digital assistant device with a battery is in use when performing such dynamic-image-data compression elongation processing on a personal digital assistant device, battery temporal duration becomes remarkably short.

[0015]on the other hand, the video transmitted and received does not necessarily need to be smooth video -- for example, the picture of a still picture or the frame rate (frame number per unit time) of about one frame per second -- necessity -- there may also be sufficient thing. In this case, since the operation amount which dynamic-image-data compression elongation processing takes will decrease if a frame rate is reduced, power consumption is also stopped low and battery-operated time becomes long.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention]According to the 1st composition of the personal digital assistant device concerning this invention, the value of the frame rate in compression processing of the dynamic image data based on the value of a frame rate and dynamic-image-data compression processing means in the image pick-up of the video by video imaging means, such as a CCD camera, Since it had the frame rate regulation means adjusted according to the operation from the outside, When a user can set up arbitrarily the frame rate of the dynamic image data transmitted and reproduced if needed and a low frame rate is set up, the power consumption by dynamic-image-data compression processing can be reduced. When a frame rate is set up lower than a predetermined value, power consumption can be further reduced by omitting the motion compensation processing in dynamic-image-data compression processing.
[0055]According to the 2nd composition of the personal digital assistant device concerning this invention, the value of the frame rate in compression processing of the dynamic image data based on the value of a frame rate and dynamic-image-data compression processing means in the image pick-up of the video by video imaging means, such as a CCD camera, Since it had the frame rate regulation means adjusted according to the remaining capacity of the battery which supplies electric power to a personal digital assistant device, The frame rate of the dynamic image data transmitted and reproduced can be set up according to the remaining capacity of a battery, and when the remaining capacity of a battery decreases, battery-operated time of a personal digital assistant device can be lengthened by setting up a frame rate low.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, it is a personal digital assistant device which can perform reception or transmission and reception of the video above until now, The thing provided with a means by which a user adjusts the frame rate of dynamic image data does not exist, but power consumption increases by processing image data by a high frame rate superfluously in a user, and there is a problem that consumption of a battery becomes quick.
[0017]This invention was made in view of this problem, it is a personal digital assistant device which can perform reception or transmission and reception of video, and that purpose is to provide the personal digital assistant device of the composition which can reduce power consumption.

[Translation done.]

MEANS

[Means for Solving the Problem]As mentioned above, since dynamic-image-data compression elongation processing needs a great operation amount, in a dynamic-image-data compression expansion circuit, power consumption becomes large. On the other hand, since battery-operated [of the personal digital assistant device] is carried out, it is necessary to control power consumption but, and if a time-varying-image-processing function tends to be included in a personal digital assistant device and it is going to realize a portable TV phone etc., battery temporal duration cannot but become short.
[0019]Then, in a personal digital assistant device concerning this invention, in order to control power consumption by dynamic-image-data compression elongation processing, a frame rate regulation means which has a frame rate regulation knob etc. which can change a frame rate of image data themselves [user] is established. H. Although an animation of about per second 15 frames is treated in a TV phone by 263 standards, for example, By there being also a case of necessity 10 minutes by a frame rate lower than this for some users, and setting a frame rate regulation knob of a frame rate regulation means to the low frame rate side in that case, A frame rate is reduced and it becomes possible to reduce power consumption and to extend battery temporal duration.
[0020]When a frame rate is low set up in video transmission, first, clock frequency of a CCD camera falls and a video sampling rate falls. Thereby, power consumption in a CCD camera can be reduced.
[0021]Next, also in image data compression processing, clock frequency is set up low, and power consumption can be reduced. Since it will become meaningless to perform a motion compensation if it becomes below a value (for example, five frames per second) with setting out of a frame rate, a motion compensation circuit is bypassed and difference processing inter-frame [each] is omitted. Thereby, power consumption by a motion compensation circuit can be eliminated.
[0022]When transmitting compressed dynamic image data, frame rate information on video is also transmitted simultaneously. Although elongation processing of dynamic image data is first performed at speed according to a frame rate of video which received, a receiver of video performs elongation processing of dynamic image data, operating dynamic image data on a curtailed schedule, when frame rate regulation is low set up rather than a frame rate of video which received.
[0023]Although a means described above is a means in case a user sets up setting out of a frame rate using a frame rate regulation means which has a frame rate regulation knob etc., A thing which it seems shall set up a frame rate for a frame rate regulation means automatically according to remaining capacity of a battery is also possible. In this case, if battery capacity decreases, a frame rate will be adjusted automatically, it will be set up low, and power consumption will be reduced.
[0024]
[Embodiment of the Invention]Hereafter, the embodiment of the personal digital assistant device concerning this invention is described, referring to drawings.
[0025]Drawing 1 is an outline view in one gestalt of operation of the personal digital assistant device concerning this invention.
[0026]The personal digital assistant device of drawing 1 comprises the frame rate regulation knob 102, the liquid crystal display screen and the input pad 103, CCD camera 104, the loudspeaker 105, the microphone 106, and the communication MODEM terminal 107 with which the main part 101 was equipped. When a user inputs into a liquid crystal display screen and the input pad 103 with an input pen etc. and it uses as a portable TV phone, The data of a picture and a sound inputted from CCD camera 104 and the microphone 106 is transmitted via the communication MODEM terminal 107, and the data of the picture and sound which received is reproduced by the liquid crystal display screen 103 and the loudspeaker 105. The frame rate of the data of the picture transmitted and reproduced can be adjusted via the frame rate regulation knob 102 by the frame rate regulation means with which the inside was

equipped.
[0027]Drawing 2 is a block lineblock diagram of the personal digital assistant device concerning a 1st embodiment of this invention.
[0028]The personal digital assistant device concerning a 1st embodiment of this invention comprises: The central processing unit (CPU) 201, the memory 202, the screen display device 205, the video compression expansion circuit 206, the communication circuit 208, and the speech processing unit 209 which were connected mutually.
CCD camera 203 connected to the video compression expansion circuit 206 via A/D converter 213.
The frame rate regulation means 207 which has the frame rate regulation knob etc. which were connected to the video compression expansion circuit 206 and CCD camera 203.
The display screen 204 connected to the screen display device 205 via the frame buffer 214 and DA converter 215, the loudspeaker 210 and the microphone 211 which were connected to the speech processing unit 209, and the battery 212 which supplies electric power to each part of this personal digital assistant device.

[0029]The central processing unit 201 controls this whole personal digital assistant device, and it performs a required operation, accessing the memory 202. The screen display device 205 displays the dynamic image data from information or the video compression expansion circuit 206 directed from the central processing unit 201 on the display screens 204, such as a liquid crystal display. The video compression expansion circuit 206 performs compression elongation processing of dynamic image data, for example according to the dynamic image data compression system by which the standard was carried out by the international standards of media integrated system video compression of H.263, MPEG4, etc. CCD camera 203 receives video from the exterior, and transmits it to a video compression expansion circuit as dynamic image data. The microphone 211 changes into an electrical signal the sound which received from the outside, and transmits it to the speech processing unit 209 as voice data. The communication circuit 208 transmits the dynamic image data from the video compression expansion circuit 206, the voice data from the speech processing unit 209, and the information from CPU201 to other information terminal equipment by a cable or radio, or receives these information from other information terminal equipment. The battery 212 supplies the electric power of ********** of this personal digital assistant device. The frame rate regulation means 207 has a mechanism in which CCD camera 203 and the video compression expansion circuit 206 are told about the frame rate value set to the frame rate regulation knob for a user to set up a frame rate.
[0030]When realizing a portable TV phone using the personal digital assistant device concerning a 1st embodiment of this invention, processing of the data in the inside of a device, etc. is performed as follows.
[0031]The dynamic image data inputted from CCD camera 203 is inputted into the video compression expansion circuit 206 via A/D converter 213, and compression processing is carried out by the video compression expansion circuit 206. Compression processing also of the voice data inputted from the microphone is carried out with the speech processing unit 209. These image data and voice data are transmitted via the communication circuit 208.
[0032]In the data compression elongation processing in the video compression expansion circuit 206, compression processing of the image data inputted from CCD camera 203 is carried out, for example according to the video compression standards of H.263 grade. Here, data compression processing is explained taking the case of the case of the method of H.263 standard.
[0033]CCD camera 203 inputs video according to the frame rate set up by the frame rate regulation means 207 via the frame rate regulation knob, and A/D converter 213, The inputted analog dynamic image signal is changed into digital dynamic image data, and it stores in the frame memory of the video compression expansion circuit 206. The video compression expansion circuit 206 compresses the dynamic image data inputted from CCD camera 203, and transmits it to the communication circuit 208. The operation clock frequency of the video compression expansion circuit 206 is controlled by the necessary minimum operation clock frequency according to the frame rate set up by the frame rate regulation means 207. When a frame rate is a less than predetermined value, for example, five frames per second, the video compression expansion circuit 206 does not perform a motion compensation, but is controlled to consider it only as the image data of the Intra picture. Since the number of bits of the data transmitted even if it does not perform a motion compensation not becoming so large, and an inter-frame motion become large when a frame rate is small, the case where a motion compensation is not made depends this on generating mostly.

[0034]Drawing 3 is a block lineblock diagram of the video compression elongation processing circuit in the personal digital assistant device concerning this invention.
[0035]This video compression elongation processing circuit An outline, PLL circuit 301, and the encoding controlling part 302, The discrete cosine transform (DCT:Discrete Cosine Transform) part 303, The quantization (Q:Quantize) part 304 and the variable wavelength numerals multiplexing device (VLC MUX:Variable Length Code Multiplexer) 305, The buffer 306, the inverse quantization (Q^{-1}) part 307, and the reverse discrete cosine transform (IDCT:Indiscrete Cosine Transform) part 308, It comprises the motion compensation (MC:Motion Compensation) part 309 and the motion detection (ME:Motion Estimation) part 310.
[0036]Image data compression processing in this video compression expansion circuit is performed as follows. The numerals shown in the parenthesis correspond to the means on drawing 3 which performs the processing concerned.
[0037](1) Ask for the difference of the image data of a present frame, and the image data of one frame ago. The direction and size (motion vector) of a motion are detected (numerals (motion detection (ME:Motion Estimation)) 310), It asks for difference with the field where only the part of the motion vector moved, and a motion compensation (MC:Motion Compensation) is performed by a 16x16-pixel macro block unit (numerals 309).
[0038](2) Carry out the discrete cosine transform (DCT:Discrete Cosine Transform) of the difference for which it asked (numerals 303), by quantizing further (Q:Quantize), compress the amount of information (numerals 304) and consider it as compression difference information.
[0039]The motion vector for which it asked by (3) and (1), and the compression difference information searched for by (2) are outputted as compressed image data (numerals 305,306).
[0040]On the other hand, the discrete cosine transform of the picture which cannot do the first picture or a motion compensation is carried out [not performing a motion compensation], and it is transmitted. As mentioned above, the picture to which such a motion compensation is not carried out is called Intra picture. On the other hand, the picture which the motion compensation was performed and became difference information with the image data of Saki's frame is called interchange picture. Usually, three are an interchange picture in about 2/of all the pictures.
[0041]Dynamic-image-data elongation processing in an image data receiver is performed as follows in a procedure contrary to the image data compression procedure in the above-mentioned image data transmitting side.
[0042](1) Carry out inverse quantization (Q^{-1}) of the image data which received (numerals 307), and carry out a reverse discrete cosine transform (IDCT:Indiscrete Cosine Transform) (numerals 308).
[0043]When the picture by which inverse quantization was carried out by (2) and (1) is an interchange picture, it shifts by the motion vector which received simultaneously, and adds to the image data of the frame in front of one.
[0044]Thus, elongation processing is performed in a video compression expansion circuit, and the image data which the communication circuit received is outputted to a display screen by a screen display device.
[0045]Drawing 4 is a block lineblock diagram of the personal digital assistant device concerning a 2nd embodiment of this invention.
[0046]The personal digital assistant device concerning a 2nd embodiment of this invention comprises: The central processing unit (CPU) 201, the memory 202, the screen display device 205, the video compression expansion circuit 206, the communication circuit 208, and the speech processing unit 209 which were connected mutually.
CCD camera 203 connected to the video compression expansion circuit 206 via A/D converter 213.
Frame rate regulation means 207' which is connected to the video compression expansion circuit 206 and CCD camera 203, and has a remaining capacity detection function of the battery 212.
The display screen 204 connected to the screen display device 205 via the frame buffer 214 and DA converter 215, The loudspeaker 210 and the microphone 211 which were connected to the speech processing unit 209, and the battery 212 which is connected to frame rate regulation means 207' for remaining capacity detection, and supplies electric power to each part of this personal digital assistant device.

[0047]The central processing unit 201 controls this whole personal digital assistant device, and it performs a required operation, accessing the memory 202. The screen display device 205 displays the dynamic image data from information or the video compression expansion circuit 206 directed from the

central processing unit 201 on the display screens 204, such as a liquid crystal display. The video compression expansion circuit 206 performs compression elongation processing of dynamic image data, for example according to the dynamic image data compression system by which the standard was carried out by the international standards of media integrated system video compression of H.263, MPEG4, etc. CCD camera 203 receives video from the exterior, and transmits it to a video compression expansion circuit as dynamic image data. The microphone 211 changes into an electrical signal the sound which received from the outside, and transmits it to the speech processing unit 209 as voice data. The communication circuit 208 transmits the dynamic image data from the video compression expansion circuit 206, the voice data from the speech processing unit 209, and the information from CPU201 to other information terminal equipment by a cable or radio, or receives these information from other information terminal equipment. The battery 212 supplies the electric power of ********** of this personal digital assistant device. Frame rate regulation means 207' detects the remaining capacity of the battery 212, and it has a mechanism in which set up a low frame rate when there is little remaining capacity, and CCD camera 203 and the video compression expansion circuit 206 are told about the set-up frame rate value.

[0048]The point that the personal digital assistant device concerning a 2nd embodiment of this invention differs from the personal digital assistant device concerning a 1st embodiment is a point that frame rate regulation means 207' detects the remaining capacity of the battery 212 rather than is operated manually, and sets up a frame rate automatically.

[0049]When realizing a portable TV phone using the personal digital assistant device concerning a 2nd embodiment of this invention, processing of the data in the inside of a device, etc. is the same as that of the personal digital assistant device applied to a 1st embodiment except for operation of frame rate regulation means 207', and is performed as follows.

[0050]The dynamic image data inputted from CCD camera 203 is inputted into the video compression expansion circuit 206 via A/D converter 213, and compression processing is carried out by the video compression expansion circuit 206. Compression processing also of the voice data inputted from the microphone is carried out with the speech processing unit 209. These image data and voice data are transmitted via the communication circuit 208.

[0051]In the data compression elongation processing in the video compression expansion circuit 206, compression processing of the image data inputted from CCD camera 203 is carried out, for example according to the video compression standards of H.263 grade. Here, data compression processing is explained taking the case of the case of the method of H.263 standard.

[0052]CCD camera 203 inputs video according to the frame rate automatically set up by frame rate regulation means 207' according to battery residual capacity, and A/D converter 213, The inputted analog dynamic image signal is changed into digital dynamic image data, and it stores in the frame memory of the video compression expansion circuit 206. The video compression expansion circuit 206 compresses the dynamic image data inputted from CCD camera 203, and transmits it to the communication circuit 208. The operation clock frequency of the video compression expansion circuit 206 is controlled by the necessary minimum operation clock frequency according to the frame rate automatically set up by frame rate regulation means 207' according to battery residual capacity. When a frame rate is a less than predetermined value, for example, five frames per second, the video compression expansion circuit 206 does not perform a motion compensation, but is controlled to consider it only as the image data of the Intra picture, and the reason is as having mentioned above in explanation of a 1st embodiment.

[0053]Image data compression processing in a video compression expansion circuit is performed like a 1st embodiment.

[Translation done.]

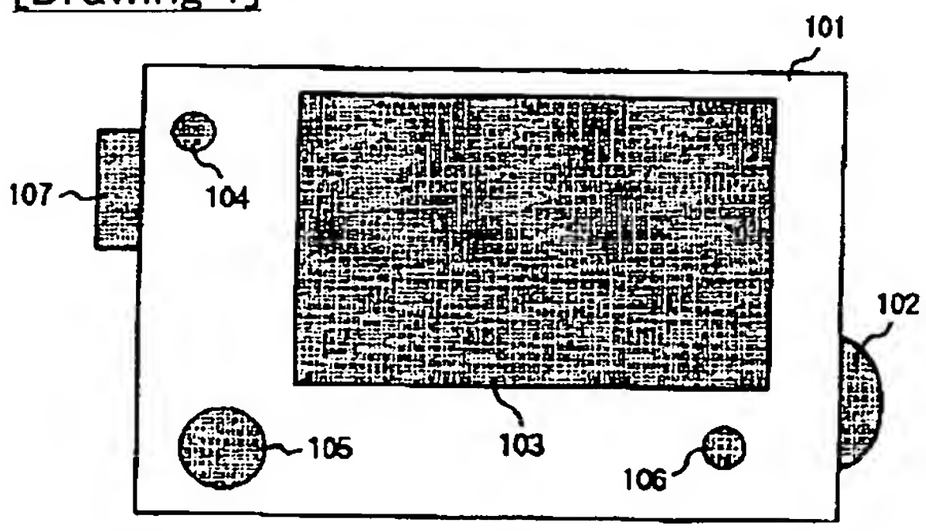
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The outline view in one gestalt of operation of the personal digital assistant device concerning this invention.
[Drawing 2]The block lineblock diagram of the personal digital assistant device concerning a 1st embodiment of this invention.
[Drawing 3]The block lineblock diagram of the video compression elongation processing circuit in the personal digital assistant device concerning this invention.
[Drawing 4]The block lineblock diagram of the personal digital assistant device concerning a 2nd embodiment of this invention.
[Drawing 5]The outline view of the example of 1 composition of the personal digital assistant device which has a portable video telephone function.
[Description of Notations]
101,501 Personal digital assistant device main frame
102 Frame rate regulation knob
103,503 A liquid crystal display screen and input pad
104,504 CCD cameras
105,505 Loudspeaker
106,506 Microphone
107,507 communication MODEM terminal
201 Central processing unit (CPU)
202 Memory
203 CCD camera
204 Display screen
205 Screen display device
206 Video compression expansion circuit
207,207' frame rate regulation means (frame rate control circuit)
208 Communication circuit
209 Voice processing circuit
210 Loudspeaker
211 Microphone
212 Battery
213 A/D converter
214 Frame buffer
215 DA converter
301 PLL circuit
302 Encoding controlling part
303 Discrete cosine transform (DCT) part
304 Quantization (Q) part
305 Variable wavelength numerals multiplexing device (VLC MUX)
306 Buffer
307 Inverse quantization (Q^{-1}) part
308 Reverse discrete cosine transform (IDCT) part
309 Motion compensation (MC) part
310 Motion detection (ME) part

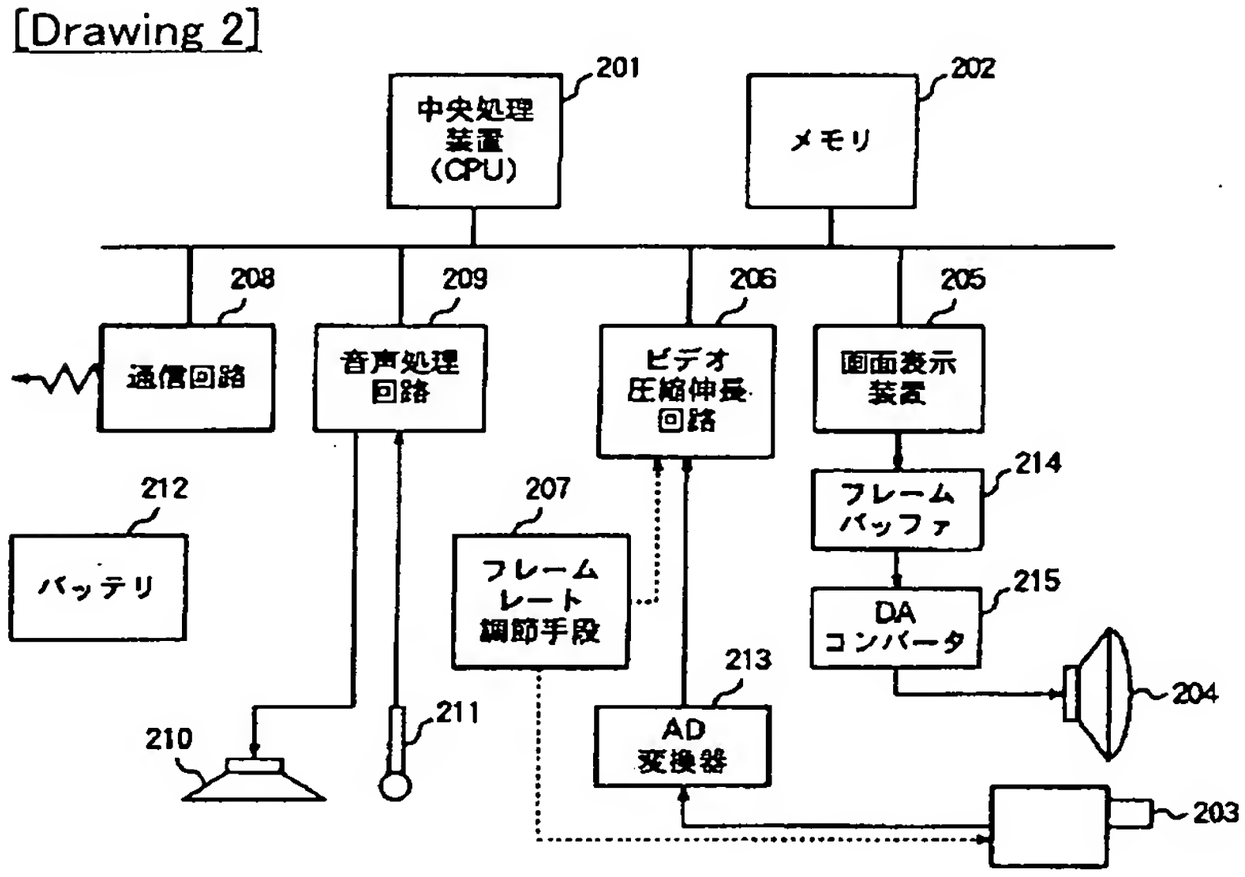
[Translation done.]

DRAWINGS

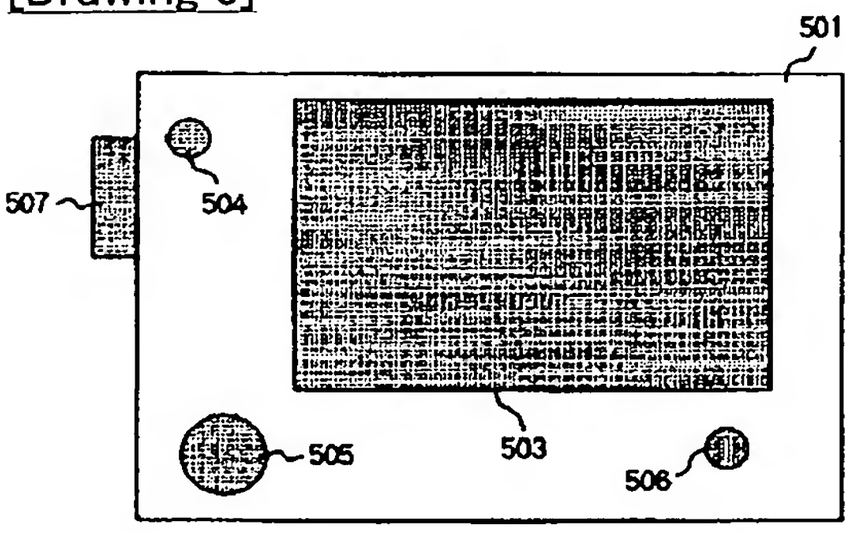
[Drawing 1]



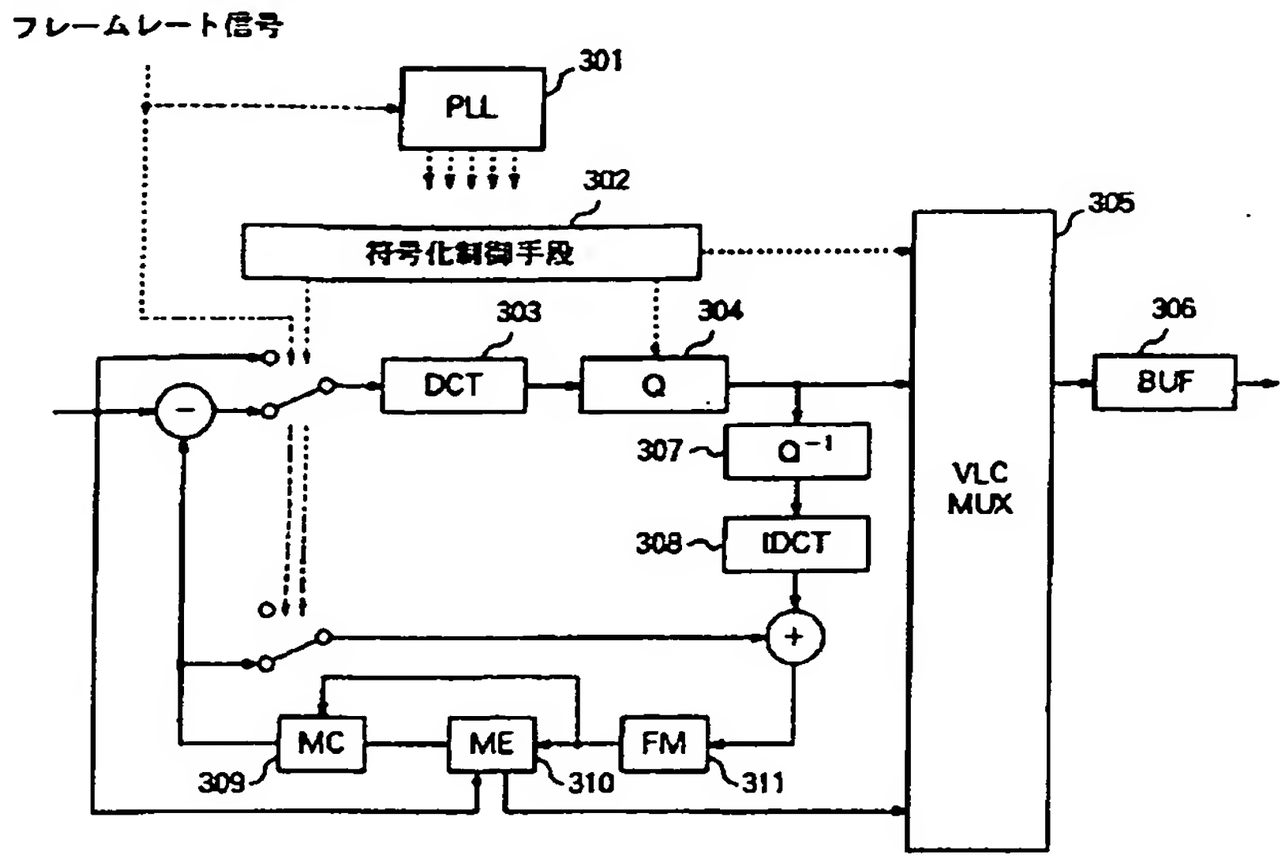
[Drawing 2]



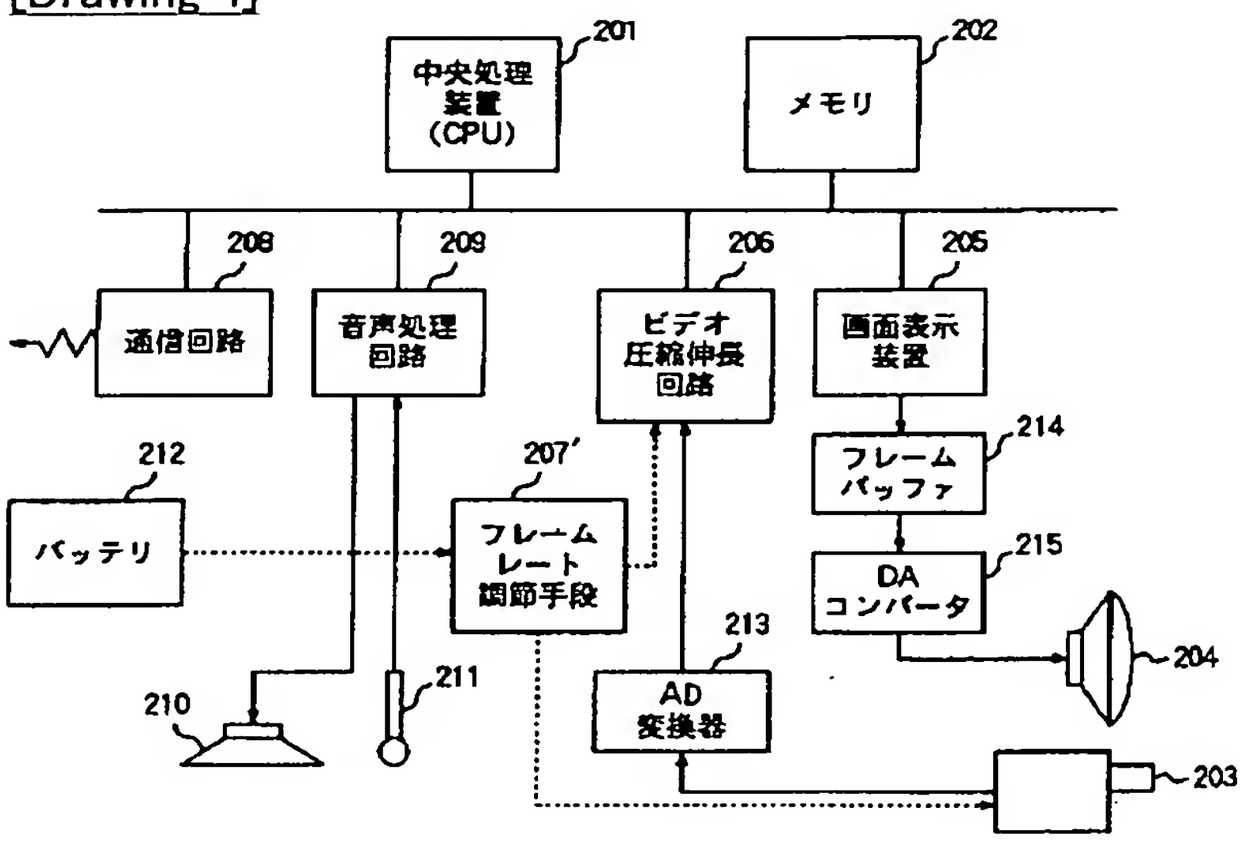
[Drawing 5]



[Drawing 3]



[Drawing 4]



[Translation done.]

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(71)出願人　000003078
株式会社東芝
神奈川県川崎市幸区堀川町72番地

(72)発明者　高　橋　真　史
神奈川県川崎市幸区堀川町580番１号　株式会社東芝半導体システム技術センター内

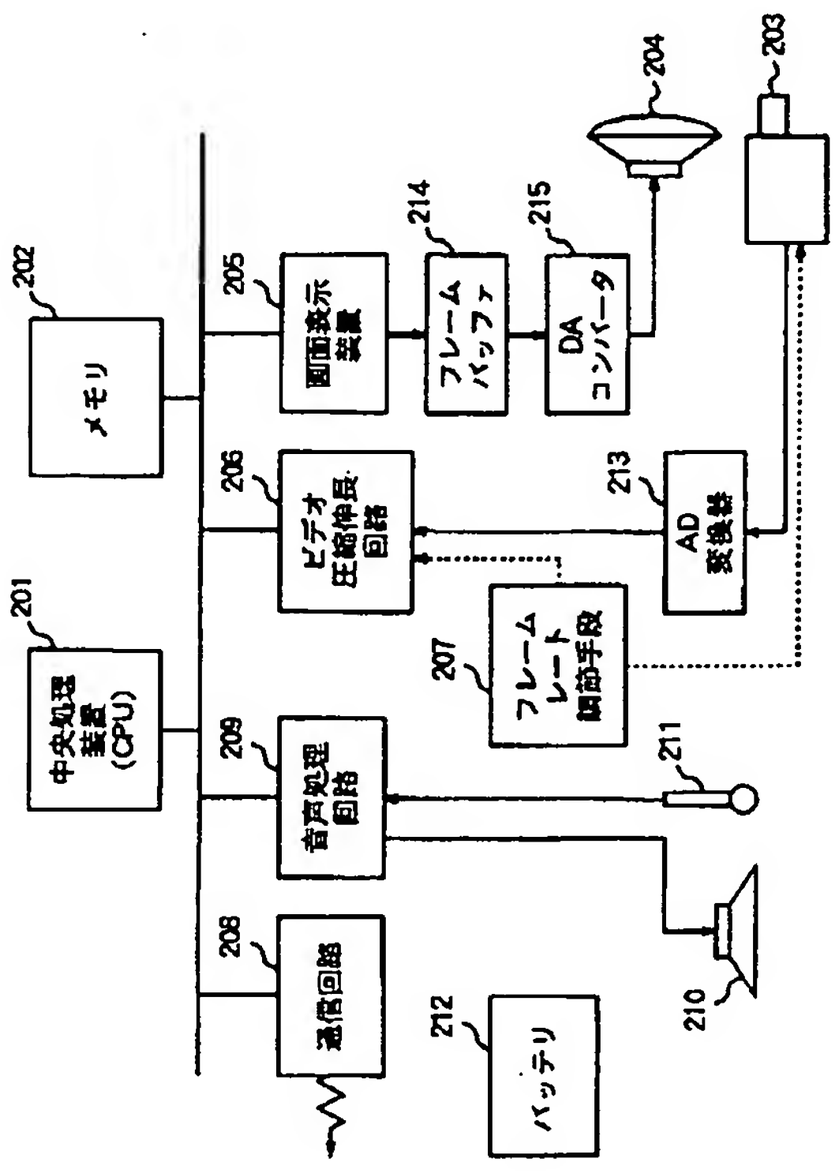
(74)代理人　弁理士　佐藤　一雄　（外３名）

(54)【発明の名称】　携帯型情報端末装置

(57)【要約】

【課題】　動画像の受信又は送受信を行うことが可能な携帯型情報端末装置であって、消費電力の低減が可能な構成の携帯型情報端末装置を提供する。

【解決手段】　本発明に係る携帯型情報端末装置は、ＣＣＤカメラ等の動画像撮像手段による動画像の撮像におけるフレームレートの値及び動画像データ圧縮処理手段による動画像データの圧縮処理におけるフレームレートの値を、外部からの操作に応じて又は携帯型情報端末装置に電力を供給するバッテリの残存容量に応じて調節するフレームレート調節手段を備えたものである。



【特許請求の範囲】

【請求項１】動画像を撮像する動画像撮像手段と、
前記動画像撮像手段により動画像を撮像して取り込んだ動画像データを圧縮処理する動画像データ圧縮処理手段と、
前記動画像データ圧縮処理手段により圧縮処理された動画像データを外部へ送信する通信手段とを有する携帯型情報端末装置において、
前記動画像撮像手段による動画像の撮像におけるフレームレートの値及び前記動画像データ圧縮処理手段による動画像データの圧縮処理におけるフレームレートの値を調節するフレームレート調節手段を備えたことを特徴とする携帯型情報端末装置。

【請求項２】請求項１に記載の携帯型情報端末装置において、さらに、
動画像を表示する動画像表示手段を備えたことを特徴とする携帯型情報端末装置。

【請求項３】請求項１又は２のいずれかに記載の携帯型情報端末装置において、
前記動画像データ圧縮処理手段の動作周波数は、前記フレームレート調節手段により調節されたフレームレートの値に応じて可変制御されることを特徴とする携帯型情報端末装置。

【請求項４】請求項３に記載の携帯型情報端末装置において、
前記動画像データ圧縮処理手段は、前記フレームレート調節手段により調節されたフレームレートの値に応じた必要最低限の演算能力が得られるように動作周波数が可変制御されることを特徴とする携帯型情報端末装置。

【請求項５】請求項１乃至４のいずれかに記載の携帯型情報端末装置において、
前記動画像データ圧縮処理手段は、フレーム間の動き補償を行う動き補償手段を有するものであることを特徴とする携帯型情報端末装置。

【請求項６】請求項５に記載の携帯型情報端末装置において、
前記フレームレート調節手段によりフレームレートの値が所定値以下に調節されたときは、前記動画像データ圧縮処理手段は、前記動き補償手段の動作を停止させ、前記動き補償を行わないようにすることを特徴とする携帯型情報端末装置。

【請求項７】請求項１乃至６のいずれかに記載の携帯型情報端末装置において、
前記フレームレート調節手段によるフレームレートの値の調節は、外部からの操作に応じて行われることを特徴とする携帯型情報端末装置。

【請求項８】請求項１乃至６のいずれかに記載の携帯型情報端末装置において、
前記フレームレート調節手段によるフレームレートの値の調節は、前記携帯型情報端末装置に電力を供給するバッテリの残存容量に応じて行われることを特徴とする携帯型情報端末装置。

【請求項９】調節された値のフレームレートで動画像を撮像するカメラと、
前記カメラにより撮像された動画像から変換された動画像データを圧縮処理する動画像データ圧縮処理手段と、
前記動画像データ圧縮処理手段により圧縮処理された動画像データを外部へ送信する通信手段と、
前記カメラによる動画像の撮像における前記フレームレートの値と、圧縮処理される動画像データのフレームレートの値とを、外部からの操作に応じて調節するフレームレート調節手段とを備え、
前記動画像データ圧縮処理手段の動作周波数は、前記フレームレート調節手段により調節されたフレームレートの値に応じて可変制御されることを特徴とする携帯型情報端末装置。

【請求項１０】電力を供給するバッテリと、
調節された値のフレームレートで動画像を撮像するカメラと、
前記カメラにより撮像された動画像から変換された動画像データを圧縮処理する動画像データ圧縮処理手段と、
前記動画像データ圧縮処理手段により圧縮処理された動画像データを外部へ送信する通信手段と、
前記カメラによる動画像の撮像における前記フレームレートの値と、圧縮処理される動画像データのフレームレートの値とを、前記バッテリの残存容量に応じて調節するフレームレート調節手段とを備え、
前記動画像データ圧縮処理手段の動作周波数は、前記フレームレート調節手段により調節されたフレームレートの値に応じて可変制御されることを特徴とする携帯型情報端末装置。

【請求項１１】請求項９又は１０のいずれかに記載の携帯型情報端末装置において、
前記動画像データ圧縮処理手段の動作周波数は、前記フレームレート調節手段により調節されたフレームレートの値に応じて、前記動画像データ圧縮処理手段における必要最低限の演算能力が得られるように可変制御されることを特徴とする携帯型情報端末装置。

【請求項１２】請求項９乃至１１のいずれかに記載の携帯型情報端末装置において、
前記動画像データ圧縮処理手段は、フレーム間の動き補償を行う動き補償手段を有するものであることを特徴とする携帯型情報端末装置。

【請求項１３】請求項１２に記載の携帯型情報端末装置において、
前記フレームレート調節手段によりフレームレートの値が所定値以下に調節されたときは、前記動画像データ圧縮処理手段は、前記動き補償手段の動作を停止させ、前記動き補償を行わないようにすることを特徴とする携帯型情報端末装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は携帯型情報端末装置に関し、特に、動画像の受信又は送受信を行い、携帯型テレビ電話等を実現する携帯型情報端末装置の消費電力の低減を可能とするものである。

【０００２】

【従来の技術】近年、自由に持ち運びできる携帯型情報端末装置のニーズが高まっている。携帯型情報端末装置とは、ＰＨＳ（Personal Handyphone System）等の携帯電話から、ＰＤＡ（Personal Data Assistant）等の個人情報ツール、さらには、サブノート型パーソナルコンピュータ等の携帯型コンピュータまで、広範囲な機器を指すものとする。

【０００３】近い将来、このような携帯型情報端末装置で、動画像の受信又は送受信を行うことが実現され、携帯型テレビ電話機能が実現されると思われる。

【０００４】図５は、携帯型テレビ電話機能を有する携帯型情報端末装置の一構成例の外観図である。

【０００５】図５の携帯型情報端末装置は、本体５０１に備えられた液晶表示画面及び入力パッド５０３、ＣＣＤカメラ５０４、スピーカ５０５、マイクロホン５０６、通信モデム端子５０７から構成されている。ユーザは、入力ペン等で液晶表示画面及び入力パッド５０３に入力を行い、携帯型テレビ電話として用いる場合は、ＣＣＤカメラ５０４及びマイクロホン５０６から入力された画像及び音声のデータを通信モデム端子５０７を介して送信し、受信した画像及び音声のデータを液晶表示画面５０３とスピーカ５０５で再生する。

【０００６】この携帯型情報端末装置を用いた画像送受信処理は、以下のように行われる。ＣＣＤカメラから入力された動画像データは、ビデオ圧縮伸長回路により圧縮され、通信回路を経て無線通信される。一方、通信回路が受信した画像データは、ビデオ圧縮伸長回路により伸長処理され、ビデオ出力装置を経て液晶表示画面５０３に出力される。このようにして、携帯型テレビ電話の機能が実現される。ビデオ圧縮伸長回路は、Ｈ．２６１、Ｈ．２６３、ＭＰＥＧ１、ＭＰＥＧ４等のメディア統合系動画像圧縮の国際標準規格に対応したものとすることが考えられる。これらの機能を実現するには、数１０～数１００ＭＯＰＳ（Million Operations Per Second）の高い処理能力を持つビデオ圧縮伸長回路が必要となり、必然的に消費電力も大きくなる。画像データ送信側における動画像データ圧縮処理手順の一例は、以下のようなものである。

【０００７】（１）現フレームの画像データと１フレーム前の画像データとの差分を求める。動きの方向及び大きさ（動きベクトル）を検出し（動き検出（ＭＥ：Motion Estimation））、動きベクトルの分だけ移動した領域との差分を求め、１６×１６画素のマクロブロック単位で動き補償（ＭＣ：Motion Compensation）を行う。

【０００８】（２）求めた差分を離散コサイン変換（ＤＣＴ：Discrete Cosine Transform）し、さらに量子化（Ｑ：Quantize）することによって情報量を圧縮し、圧縮差分情報とする。

【０００９】（３）（１）で求めた動きベクトルと（２）で求めた圧縮差分情報を、圧縮画像データとして出力する。

【００１０】一方、最初の画像又は動き補償のできない画像は、動き補償を行わず、離散コサイン変換して転送する。このような動き補償が行われない画像をイントラ画像という。これに対して、動き補償が行われて前のフレームの画像データとの差分情報となった画像をインター画像という。通常、全画像の約２／３がインター画像である。

【００１１】画像データ受信側における動画像データ伸長処理は、上記の画像データ送信側における画像データ圧縮処理手順と逆の手順で以下のように行われる。

【００１２】（１）受信した画像データを逆量子化（Q^{-1}）し、逆離散コサイン変換（ＩＤＣＴ：Indiscrete Cosine Transform）する。

【００１３】（２）（１）で逆量子化された画像がインター画像の場合、同時に受信した動きベクトル分だけずらして１つ前のフレームの画像データに足し込む。

【００１４】このような動画像データ圧縮伸長処理を携帯型情報端末装置上で行う場合、携帯型情報端末装置はバッテリで駆動されるものが主流なので、バッテリ持続時間が著しく短くなる。

【００１５】一方、送受信される動画像は、必ずしもなめらかな動画像である必要はなく、例えば、静止画や１フレーム／秒程度のフレームレート（単位時間当たりのフレーム数）の画像で必要十分なこともあり得る。この場合、フレームレートを低下させれば動画像データ圧縮伸長処理に要する演算量が減少するので、消費電力も低く抑えられ、バッテリ駆動時間が長くなる。

【００１６】

【発明が解決しようとする課題】しかしながら、これまで上述のような動画像の受信又は送受信を行うことが可能な携帯型情報端末装置であって、動画像データのフレームレートをユーザが調節する手段を備えたものは存在せず、ユーザにおいて不必要に高いフレームレートで画像データの処理をすることにより消費電力が増大し、バッテリの消耗が速くなるという問題がある。

【００１７】本発明はこの問題点に鑑みてなされたもので、その目的は、動画像の受信又は送受信を行うことが可能な携帯型情報端末装置であって、消費電力の低減が可能な構成の携帯型情報端末装置を提供することである。

【００１８】

【課題を解決するための手段】上述のように、動画像デ

ータ圧縮伸長処理は、多大な演算量を必要とするため、動画像データ圧縮伸長回路は消費電力が大きくなる。一方、携帯型情報端末装置は、バッテリ駆動されるため消費電力を抑制する必要があるが、携帯型情報端末装置に動画像処理機能を組み込み、携帯型テレビ電話等を実現しようとするとバッテリ持続時間が短くならざるを得ない。

【００１９】そこで、本発明に係る携帯型情報端末装置においては、動画像データ圧縮伸長処理による消費電力を抑制するため、ユーザ自ら画像データのフレームレートを変更できるフレームレート調節つまみ等を有するフレームレート調節手段を設ける。Ｈ．２６３規格によるテレビ電話では、例えば毎秒１５フレーム程度の動画を扱うが、ユーザによってはこれより低いフレームレートで必要十分の場合もあり、その場合はフレームレート調節手段のフレームレート調節つまみを低フレームレート側に設定することにより、フレームレートを低下させ、消費電力を低減してバッテリ持続時間を延長することが可能となる。

【００２０】動画像送信においてフレームレートが低く設定された場合、まず、ＣＣＤカメラの動作周波数が低下し、動画像サンプリングレートが低下する。これによりＣＣＤカメラにおける消費電力が低減できる。

【００２１】次に画像データ圧縮処理においても動作周波数が低く設定され、消費電力が低減できる。また、フレームレートの設定がある値（例えば５フレーム／秒）以下になると動き補償を行うことが無意味となるため、動き補償回路をバイパスし、各フレーム間の差分処理を省略する。これにより、動き補償回路による消費電力を無くすることができる。

【００２２】圧縮した動画像データを送信するときには、動画像のフレームレート情報も同時に送信する。動画像の受信側は、まず、受信した動画像のフレームレートに応じた速度で動画像データの伸長処理を行うが、受信した動画像のフレームレートよりもフレームレート調節が低く設定されている場合は、動画像データを間引きしながら動画像データの伸長処理を行う。

【００２３】以上に述べた手段は、フレームレートの設定をフレームレート調節つまみ等を有するフレームレート調節手段を用いてユーザが設定する場合の手段であるが、フレームレート調節手段を、バッテリの残存容量に応じて自動的にフレームレートを設定するようなものとすることも可能である。この場合、バッテリ容量が減少すると、自動的にフレームレートが調節されて低く設定され、消費電力が低減される。

【００２４】

【発明の実施の形態】以下、本発明に係る携帯型情報端末装置の実施の形態について、図面を参照しながら説明する。

【００２５】図１は、本発明に係る携帯型情報端末装置

の実施の一形態における外観図である。

【００２６】図１の携帯型情報端末装置は、本体１０１に備えられたフレームレート調節つまみ１０２、液晶表示画面及び入力パッド１０３、ＣＣＤカメラ１０４、スピーカ１０５、マイクロホン１０６、通信モデム端子１０７から構成されている。ユーザは、入力ペン等で液晶表示画面及び入力パッド１０３に入力を行い、携帯型テレビ電話として用いる場合は、ＣＣＤカメラ１０４及びマイクロホン１０６から入力された画像及び音声のデータを通信モデム端子１０７を介して送信し、受信した画像及び音声のデータを液晶表示画面１０３とスピーカ１０５で再生する。送信及び再生される画像のデータのフレームレートは、フレームレート調節つまみ１０２を介して、内部に備えられたフレームレート調節手段により調節することができる。

【００２７】図２は、本発明の第１の実施の形態に係る携帯型情報端末装置のブロック構成図である。

【００２８】本発明の第１の実施の形態に係る携帯型情報端末装置は、相互に接続された中央処理装置（ＣＰＵ）２０１、メモリ２０２、画面表示装置２０５、ビデオ圧縮伸長回路２０６、通信回路２０８及び音声処理装置２０９と、ＡＤ変換器２１３を介してビデオ圧縮伸長回路２０６に接続されたＣＣＤカメラ２０３と、ビデオ圧縮伸長回路２０６及びＣＣＤカメラ２０３に接続されたフレームレート調節つまみ等を有するフレームレート調節手段２０７と、フレームバッファ２１４及びＤＡコンバータ２１５を介して画面表示装置２０５に接続された表示画面２０４と、音声処理装置２０９に接続されたスピーカ２１０及びマイクロホン２１１と、この携帯型情報端末装置の各部に電力を供給するバッテリ２１２とから構成されている。

【００２９】中央処理装置２０１は、この携帯型情報端末装置全体を制御し、メモリ２０２にアクセスしながら必要な演算を行う。画面表示装置２０５は、中央処理装置２０１から指示される情報あるいはビデオ圧縮伸長回路２０６からの動画像データを液晶画面等の表示画面２０４に表示する。ビデオ圧縮伸長回路２０６は、例えばＨ．２６３やＭＰＥＧ４等のメディア統合系動画像圧縮の国際標準で規格された動画像データ圧縮方式に従って、動画像データの圧縮伸長処理を行う。ＣＣＤカメラ２０３は、外部から動画像を受信し、ビデオ圧縮伸長回路に動画像データとして転送する。マイクロホン２１１は、外部から受信した音声を電気信号に変換し、音声データとして音声処理装置２０９に転送する。通信回路２０８は、ビデオ圧縮伸長回路２０６からの動画像データ、音声処理装置２０９からの音声データ、及びＣＰＵ２０１からの情報を有線又は無線で他の情報端末装置に送信し又は他の情報端末装置からこれらの情報を受信する。バッテリ２１２は、この携帯型情報端末装置のシステム全体への電力を供給する。フレームレート調節手段

２０７は、ユーザがフレームレートを設定するためのフレームレート調節つまみと、設定されたフレームレート値をＣＣＤカメラ２０３、ビデオ圧縮伸長回路２０６に知らせる機構を有する。

【００３０】本発明の第１の実施の形態に係る携帯型情報端末装置を用いて携帯型テレビ電話を実現する場合、装置内部におけるデータ等の処理は以下のように行われる。

【００３１】ＣＣＤカメラ２０３から入力された動画像データは、ＡＤ変換器２１３を介してビデオ圧縮伸長回路２０６に入力され、ビデオ圧縮伸長回路２０６により圧縮処理される。マイクから入力された音声データも音声処理装置２０９で圧縮処理される。これら画像データ及び音声データは、通信回路２０８を介して送信される。

【００３２】ビデオ圧縮伸長回路２０６におけるデータ圧縮伸長処理では、ＣＣＤカメラ２０３から入力される画像データを、例えばH．２６３等の動画像圧縮標準規格に従って圧縮処理する。ここでは、H．２６３規格の方式の場合を例にとってデータ圧縮処理について説明する。

【００３３】ＣＣＤカメラ２０３は、フレームレート調節つまみを介してフレームレート調節手段２０７により設定されたフレームレートに従って動画像を入力し、ＡＤ変換器２１３は、入力されたアナログ動画像信号をデジタル動画像データに変換してビデオ圧縮伸長回路２０６のフレームメモリに格納する。ビデオ圧縮伸長回路２０６は、ＣＣＤカメラ２０３から入力される動画像データを圧縮し、通信回路２０８に転送する。ビデオ圧縮伸長回路２０６の動作クロック周波数は、フレームレート調節手段２０７により設定されたフレームレートに従って必要最低限の動作クロック周波数に制御される。また、ビデオ圧縮伸長回路２０６は、フレームレートが所定値、例えば５フレーム／秒以下の場合は、動き補償を行わず、イントラ画像の画像データのみとするように制御される。これは、フレームレートが小さい場合、動き補償を行わなくても転送されるデータのビット数がそれほど大きくならないこと、及び、フレーム間の動きが大きくなるため、動き補償ができない場合が多く発生することによる。

【００３４】図３は、本発明に係る携帯型情報端末装置におけるビデオ圧縮伸長処理回路のブロック構成図である。

【００３５】このビデオ圧縮伸長処理回路は、概略、ＰＬＬ回路３０１と、符号化制御部３０２と、離散コサイン変換（ＤＣＴ：Discrete Cosine Transform ）部３０３と、量子化（Q：Quantize）部３０４と、可変波長符号多重化装置（ＶＬＣ　ＭＵＸ：Variable Length Code Multiplexer）３０５と、バッファ３０６と、逆量子化（Q^{-1}）部３０７と、逆離散コサイン変換（ＩＤＣＴ：Indiscrete Cosine Transform ）部３０８と、動き補償（ＭＣ：Motion Compensation ）部３０９と、動き検出（ＭＥ：Motion Estimation ）部３１０とから構成されている。

【００３６】このビデオ圧縮伸長回路における画像データ圧縮処理は、以下のように行われる。尚、かっこ内に示した符号は、当該処理を行う図３上の手段に対応するものである。

【００３７】（１）現フレームの画像データと１フレーム前の画像データとの差分を求める。動きの方向及び大きさ（動きベクトル）を検出し（動き検出（ＭＥ：Motion Estimation ））（符号３１０）、動きベクトルの分だけ移動した領域との差分を求め、１６×１６画素のマクロブロック単位で動き補償（ＭＣ：Motion Compensation ）を行う（符号３０９）。

【００３８】（２）求めた差分を離散コサイン変換（ＤＣＴ：Discrete Cosine Transform）し（符号３０３）、さらに量子化（Q：Quantize）することによって情報量を圧縮し（符号３０４）、圧縮差分情報とする。

【００３９】（３）（１）で求めた動きベクトルと（２）で求めた圧縮差分情報を、圧縮画像データとして出力する（符号３０５，３０６）。

【００４０】一方、最初の画像又は動き補償のできない画像は、動き補償を行わず、離散コサイン変換して転送する。前述のように、このような動き補償が行われない画像をイントラ画像という。これに対して、動き補償が行われて前のフレームの画像データとの差分情報となった画像をインター画像という。通常、全画像の約２／３がインター画像である。

【００４１】画像データ受信側における動画像データ伸長処理は、上記の画像データ送信側における画像データ圧縮処理手順と逆の手順で以下のように行われる。

【００４２】（１）受信した画像データを逆量子化（Q^{-1}）し（符号３０７）、逆離散コサイン変換（ＩＤＣＴ：Indiscrete Cosine Transform ）する（符号３０８）。

【００４３】（２）（１）で逆量子化された画像がインター画像の場合、同時に受信した動きベクトル分だけずらして１つ前のフレームの画像データに足し込む。

【００４４】このように通信回路が受信した画像データは、ビデオ圧縮伸長回路で伸長処理が行われ、画面表示装置により表示画面に出力される。

【００４５】図４は、本発明の第２の実施の形態に係る携帯型情報端末装置のブロック構成図である。

【００４６】本発明の第２の実施の形態に係る携帯型情報端末装置は、相互に接続された中央処理装置（ＣＰＵ）２０１、メモリ２０２、画面表示装置２０５、ビデオ圧縮伸長回路２０６、通信回路２０８及び音声処理装置２０９と、ＡＤ変換器２１３を介してビデオ圧縮伸長回路２０６に接続されたＣＣＤカメラ２０３と、ビデオ

圧縮伸長回路２０６及びＣＣＤカメラ２０３に接続され、バッテリ２１２の残存容量検出機能を有するフレームレート調節手段２０７’と、フレームバッファ２１４及びＤＡコンバータ２１５を介して画面表示装置２０５に接続された表示画面２０４と、音声処理装置２０９に接続されたスピーカ２１０及びマイクロホン２１１と、残存容量検出のためフレームレート調節手段２０７’に接続され、この携帯型情報端末装置の各部に電力を供給するバッテリ２１２とから構成されている。

【００４７】中央処理装置２０１は、この携帯型情報端末装置全体を制御し、メモリ２０２にアクセスしながら必要な演算を行う。画面表示装置２０５は、中央処理装置２０１から指示される情報あるいはビデオ圧縮伸長回路２０６からの動画像データを液晶画面等の表示画面２０４に表示する。ビデオ圧縮伸長回路２０６は、例えばＨ．２６３やＭＰＥＧ４等のメディア統合系動画像圧縮の国際標準で規格された動画像データ圧縮方式に従って、動画像データの圧縮伸長処理を行う。ＣＣＤカメラ２０３は、外部から動画像を受信し、ビデオ圧縮伸長回路に動画像データとして転送する。マイクロホン２１１は、外部から受信した音声を電気信号に変換し、音声データとして音声処理装置２０９に転送する。通信回路２０８は、ビデオ圧縮伸長回路２０６からの動画像データ、音声処理装置２０９からの音声データ、及びＣＰＵ２０１からの情報を有線又は無線で他の情報端末装置に送信し又は他の情報端末装置からこれらの情報を受信する。バッテリ２１２は、この携帯型情報端末装置のシステム全体への電力を供給する。フレームレート調節手段２０７’は、バッテリ２１２の残存容量を検知し、残存容量が少ない場合は低いフレームレートを設定して、設定されたフレームレート値をＣＣＤカメラ２０３、ビデオ圧縮伸長回路２０６に知らせる機構を有する。

【００４８】本発明の第２の実施の形態に係る携帯型情報端末装置が、第１の実施の形態に係る携帯型情報端末装置と異なる点は、フレームレート調節手段２０７’が手動で操作されるのではなく、バッテリ２１２の残存容量を検知して自動的にフレームレートを設定する点である。

【００４９】本発明の第２の実施の形態に係る携帯型情報端末装置を用いて携帯型テレビ電話を実現する場合、装置内部におけるデータ等の処理は、フレームレート調節手段２０７’の動作を除き第１の実施の形態に係る携帯型情報端末装置と同様であり、以下のように行われる。

【００５０】ＣＣＤカメラ２０３から入力された動画像データは、ＡＤ変換器２１３を介してビデオ圧縮伸長回路２０６に入力され、ビデオ圧縮伸長回路２０６により圧縮処理される。マイクから入力された音声データも音声処理装置２０９で圧縮処理される。これら画像データ及び音声データは、通信回路２０８を介して送信される。

【００５１】ビデオ圧縮伸長回路２０６におけるデータ圧縮伸長処理では、ＣＣＤカメラ２０３から入力される画像データを、例えばＨ．２６３等の動画像圧縮標準規格に従って圧縮処理する。ここでは、Ｈ．２６３規格の方式の場合を例にとってデータ圧縮処理について説明する。

【００５２】ＣＣＤカメラ２０３は、バッテリ残存容量に応じてフレームレート調節手段２０７’により自動的に設定されたフレームレートに従って動画像を入力し、ＡＤ変換器２１３は、入力されたアナログ動画像信号をデジタル動画像データに変換してビデオ圧縮伸長回路２０６のフレームメモリに格納する。ビデオ圧縮伸長回路２０６は、ＣＣＤカメラ２０３から入力される動画像データを圧縮し、通信回路２０８に転送する。ビデオ圧縮伸長回路２０６の動作クロック周波数は、バッテリ残存容量に応じてフレームレート調節手段２０７’により自動的に設定されたフレームレートに従って必要最低限の動作クロック周波数に制御される。また、ビデオ圧縮伸長回路２０６は、フレームレートが所定値、例えば５フレーム／秒以下の場合は、動き補償を行わず、イントラ画像の画像データのみとするように制御され、その理由は、第１の実施の形態の説明において上述した通りである。

【００５３】尚、ビデオ圧縮伸長回路における画像データ圧縮処理は、第１の実施の形態と同様に行われる。

【００５４】

【発明の効果】本発明に係る携帯型情報端末装置の第１の構成によれば、ＣＣＤカメラ等の動画像撮像手段による動画像の撮像におけるフレームレートの値及び動画像データ圧縮処理手段による動画像データの圧縮処理におけるフレームレートの値を、外部からの操作に応じて調節するフレームレート調節手段を備えたので、送信及び再生される動画像データのフレームレートをユーザが必要に応じて任意に設定することができ、低いフレームレートを設定したときには、動画像データ圧縮処理による消費電力を低減することができる。また、フレームレートを所定値より低く設定したときには、動画像データ圧縮処理における動き補償処理を省略することにより、消費電力をさらに低減することができる。

【００５５】本発明に係る携帯型情報端末装置の第２の構成によれば、ＣＣＤカメラ等の動画像撮像手段による動画像の撮像におけるフレームレートの値及び動画像データ圧縮処理手段による動画像データの圧縮処理におけるフレームレートの値を、携帯型情報端末装置に電力を供給するバッテリの残存容量に応じて調節するフレームレート調節手段を備えたので、送信及び再生される動画像データのフレームレートをバッテリの残存容量に応じて設定することができ、バッテリの残存容量が少なくなったときにはフレームレートが低く設定されるようにす

ることにより、携帯型情報端末装置のバッテリ駆動時間を長くすることができる。

【図面の簡単な説明】

【図１】本発明に係る携帯型情報端末装置の実施の一形態における外観図。

【図２】本発明の第１の実施の形態に係る携帯型情報端末装置のブロック構成図。

【図３】本発明に係る携帯型情報端末装置におけるビデオ圧縮伸長処理回路のブロック構成図。

【図４】本発明の第２の実施の形態に係る携帯型情報端末装置のブロック構成図。

【図５】携帯型テレビ電話機能を有する携帯型情報端末装置の一構成例の外観図。

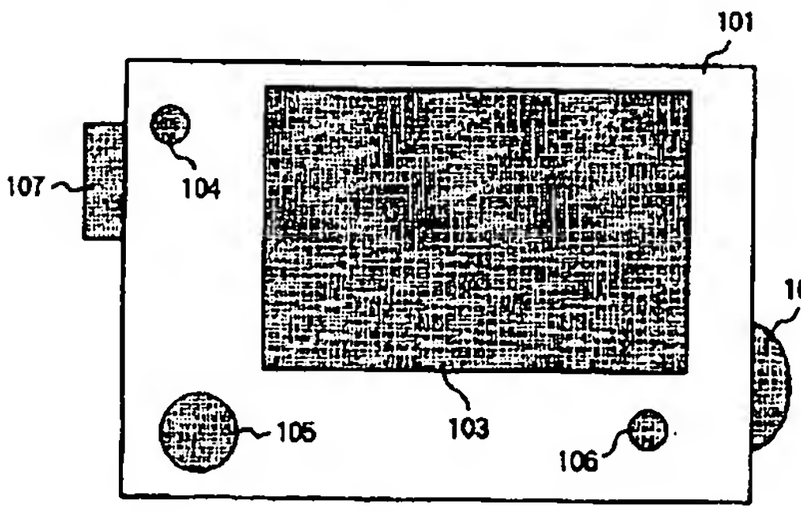
【符号の説明】

１０１，５０１　携帯型情報端末装置本体
１０２　フレームレート調節つまみ
１０３，５０３　液晶表示画面及び入力パッド
１０４，５０４　ＣＣＤカメラ
１０５，５０５　スピーカ
１０６，５０６　マイクロホン
１０７，５０７　通信モデム端子
２０１　中央処理装置（ＣＰＵ）
２０２　メモリ
２０３　ＣＣＤカメラ

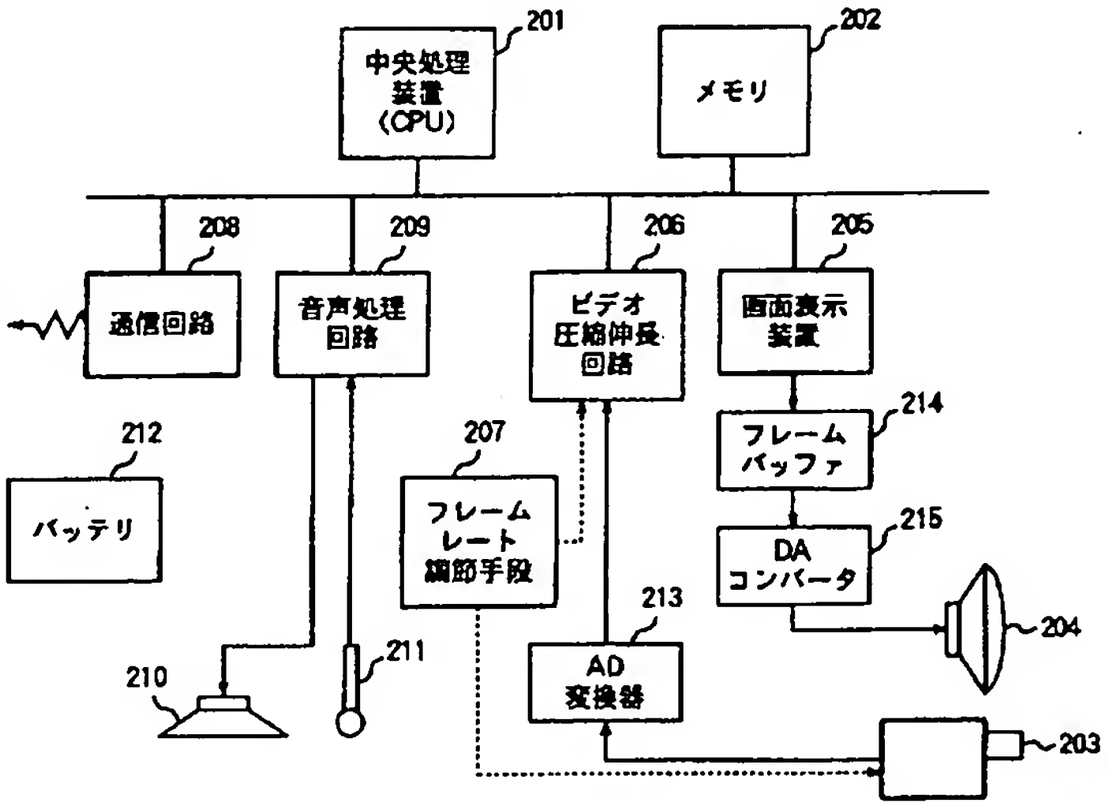
＊２０４　表示画面
２０５　画面表示装置
２０６　ビデオ圧縮伸長回路
２０７，２０７’　フレームレート調節手段（フレームレート調節回路）
２０８　通信回路
２０９　音声処理回路
２１０　スピーカ
２１１　マイクロホン
２１２　バッテリ
２１３　ＡＤ変換器
２１４　フレームバッファ
２１５　ＤＡコンバータ
３０１　ＰＬＬ回路
３０２　符号化制御部
３０３　離散コサイン変換（ＤＣＴ）部
３０４　量子化（Ｑ）部
３０５　可変波長符号多重化装置（ＶＬＣ　ＭＵＸ）
３０６　バッファ
３０７　逆量子化（Q^{-1}）部
３０８　逆離散コサイン変換（ＩＤＣＴ）部
３０９　動き補償（ＭＣ）部
３１０　動き検出（ＭＥ）部

＊

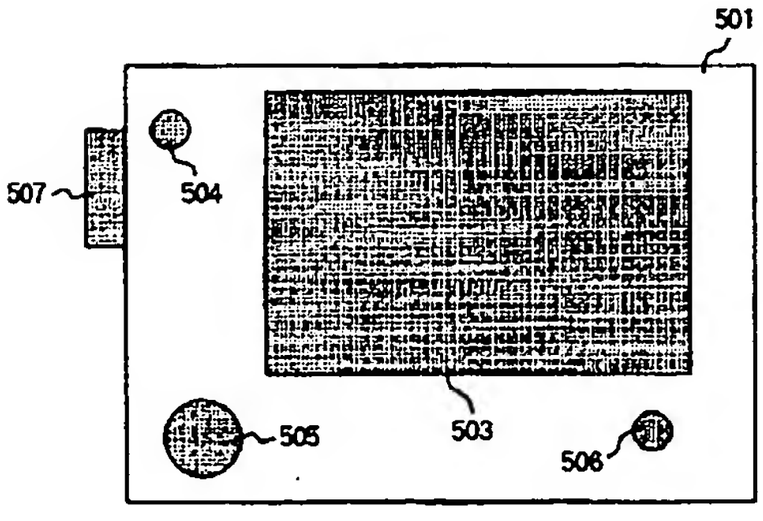
【図１】



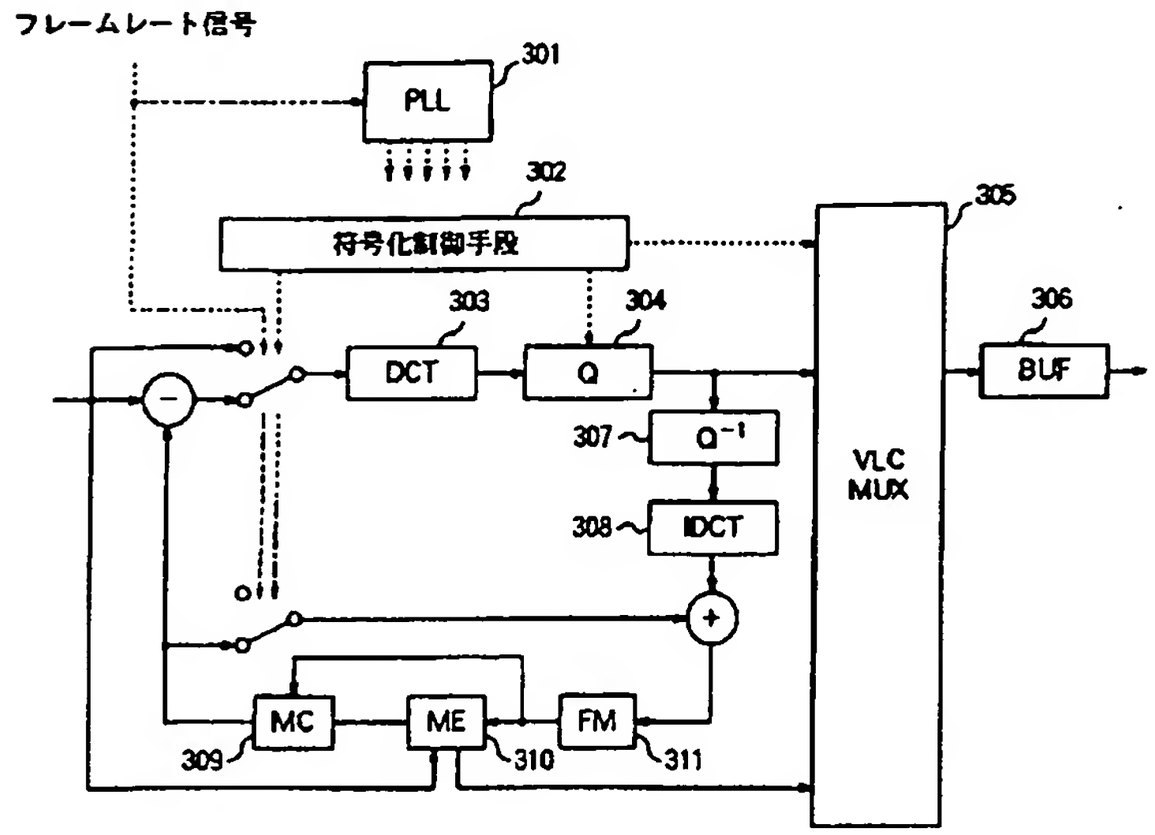
【図２】



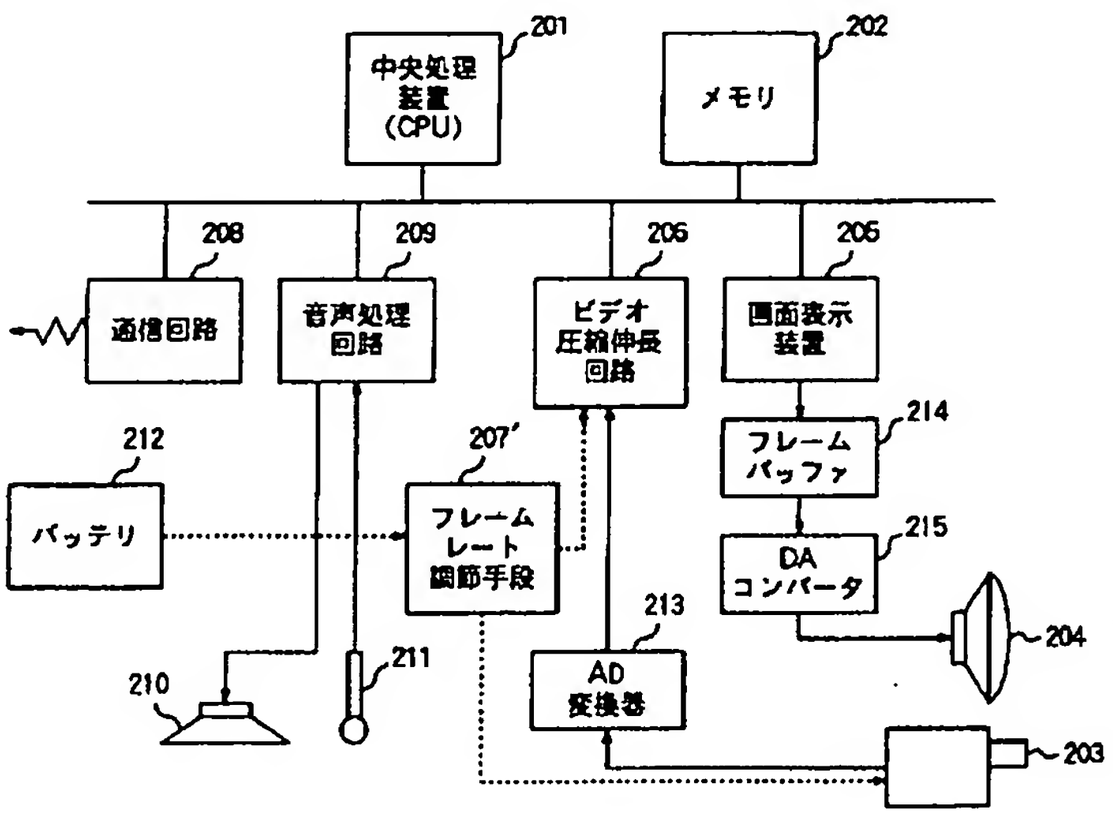
【図５】



【図３】


フレームレート信号
PLL
301
302
符号化制御手段
305
303
304
306
DCT
Q
BUF
307
Q⁻¹
VLC
MUX
308
IDCT
MC
ME
FM
309
310
311

【図４】


201
中央処理
装置
(CPU)
202
メモリ
208
209
206
205
通信回路
音声処理
回路
ビデオ
圧縮伸長
回路
画面表示
装置
214
212
207'
フレーム
バッファ
バッテリ
フレーム
レート
調節手段
215
DA
コンバータ
213
204
210
211
AD
変換器
203